86. Proposed by GEORGE LILLEY, Ph. D., LL. D., Professor of Mathematics, University of Oregon, Eugene, Oregon.

A gave two notes; one for a dollars at m per cent., and the other for b dollars at n per cent., annual interest. He is to make a monthly payment of c dollars. How much must be endorsed on each note in order to pay them off at the same time? What must be the payment on each if $a=1900$, $b=1800$, $m=6$, $n=7$, and $c=25$?

Solution by WM. FRED FLEMING, Principal of High School, Denison, Texas.

One general formula for finding the number of fixed monthly payments required to extinguish a debt which bears interest is as follows:

$$\text{Number of payments}=\frac{\log\left(\frac{p}{p-mP}\right)}{\log(m+1)}$$

where p=payment, P=principal, and m=fraction of principal accruing as monthly interest.

In the given problem the number of payments is equal since the notes are to be lifted at the same time. Hence

$$\frac{\log\left(\frac{p}{p-10.50}\right)}{\log(\frac{7}{1200}+1)}=\frac{\log\left(\frac{25-p}{25-p-9.50}\right)}{\log(\frac{1}{200}+1)}.$$

Whence, using 7-figure logarithms,

$$\frac{p}{p-\frac{21}{2}}=\left(\frac{25-p}{\frac{31}{2}-p}\right)^{1.1662}$$

which equation, solved by double position (or some other method of approximation) gives, as the nearest payments involving *even cents*, \$12.74 for the payment on the \$1800 note, and \$12.26 as payment on the \$1900 note.

Number of payments=298.9, or 24 years and 11 months (nearly) will be required to lift the note.

PROBLEMS FOR SOLUTION.

ARITHMETIC.

136. Proposed by F. M. PRIEST, Mona House, St. Louis, Mo.

What is the size of the smallest cubical box, inside dimension, that will contain four balls each ten inches in diameter?

137. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

At the corners of a triangle sides a, b, c feet are towers d, e, f feet high. At what point must a ladder be placed so that it will just reach to the top of each tower without moving? How long is the ladder? Substitute $a=200$, $b=180$, $c=150$, $d=60$, $e=50$, $f=30$; d, e, f at A, B, C, respectively.

*** Solutions of these problems should be sent to B. F. Finkel not later than Jan. 10.

ALGEBRA.

125. Proposed by LESLIE L. LOCKE, Instructor in Mathematics, Michigan Agricultural College, Ingram County, Mich.

What special expedient will solve the system

$$\left.\begin{array}{l} x^4-y^4=369 \\ x-y=1 \end{array}\right\}?$$

126. Proposed by CHARLES C. CROSS, Meredithville, Va.

A and B run a race; B, who runs slower than A by a miles in b hours, starts first by c minutes, and they get to the n-mile stone together; required their rates of running. If $a=1$, $b=2$, $c=2$, and $n=4$, what is the result?

*** Solutions of these problems should be sent to J. M. Colaw not later than Jan. 10.

GEOMETRY.

154. Proposed by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, University of Mississippi, P. O., University, Miss.

The angle between the edge of a trihedral angle and the bisector of the opposite face angle is less than, equal to, or greater than, half the sum of the other two face angles, according as it is itself acute, right, or obtuse.

155. Proposed by J. C. NAGLE, M. A., M. C. E., Professor of Civil Engineering, State Agricultural and Mechanical College, College Station, Tex.

A special case of the following problem was sent me some time ago by an ex-member of one of my engineering classes, as occuring on the Southern Pacific Ry. near Devil's River:

Two straight tracks, p feet between centers, are to be united by a cross-over composed of two curves of radius R, and a length L of intervening tangent. Required the central angles and the distance between tangent points, measured along main track. In the special case referred to p was 62 feet, L 100 feet with $9°\ 30'$ curves.

156. Proposed by F. M. McGAW, A. M., Professor of Mathemstics, Bordentown Military Institute, Bordentown, N. J.

To construct an equilateral triangle such that its vertices shall be in each of two parallel lines and a point fixed between these lines.

*** Solutions of these problems should be sent to B. F. Finkel not later than Jan. 10.

CALCULUS.

116. Proposed by JOHN M. COLAW, A. M., Monterey. Va.

"Prove that the length of the *greatest* beam of square section that can be cut from a log l feet long and in the shape of a conic frustum, diameters D and d, is $\frac{1}{3}lD\div(D-d)$ feet."